In the Claims

1. (original) A method used to form a semiconductor device, comprising:

placing a semiconductor wafer substrate assembly having a surface into a deposition chamber;

introducing cyclopentadienylcobalt dicarbonyl into the chamber to deposit a cobalt metal precursor layer by atomic layer deposition over the surface of the semiconductor wafer substrate assembly; and

introducing hydrogen into the deposition chamber to convert the precursor layer such that a pure metal layer of cobalt remains over the surface of the semiconductor wafer substrate assembly.

2. (original) The method of claim 1 wherein the introduction of hydrogen into the deposition chamber results in a pure metal layer of cobalt which covers about 33% of the semiconductor wafer substrate assembly surface.

3. (original) The method of claim 1 further comprising performing the introduction of cyclopentadienylcobalt dicarbonyl then the introduction of hydrogen a plurality of times to form a blanket pure metal layer of cobalt.

4. (original) The method of claim 1 further comprising:

forming a silicon plug as part of the semiconductor wafer substrate assembly;

subsequent to forming the silicon plug, placing the semiconductor wafer substrate assembly into the deposition chamber;

depositing the cobalt metal precursor layer on the silicon plug;

converting the precursor layer on the silicon plug to the pure metal layer of cobalt; and

annealing the pure metal layer of cobalt on the silicon plug to react the pure metal layer of cobalt with the silicon plug to convert the pure metal layer of cobalt on the plug to cobalt silicide.

5. (original) The method of claim 1 further comprising:

flowing cyclopentadienylcobalt dicarbonyl and a carrier gas into the chamber at a flow rate of between about 0.0 standard cubic centimeters per minute (sccm) and about 1,000 sccm for a duration of between about 0.1 seconds and about 10 seconds during the introduction of cyclopentadienylcobalt dicarbonyl into the deposition chamber;

maintaining the wafer substrate assembly at a temperature of between about 220°C and about 320°C during the introduction of cyclopentadienylcobalt dicarbonyl into the deposition chamber.

6. (original) A method used to form a semiconductor device comprising:

placing a semiconductor wafer substrate assembly surface comprising an dielectric layer and a silicon layer into a deposition chamber;

exposing the dielectric layer and the silicon layer to cyclopentadienylcobalt dicarbonyl to form a cobalt precursor layer on the dielectric layer and on the silicon layer;

exposing the cobalt precursor layer to a reducer which converts the cobalt precursor layer to a pure metal layer of cobalt;

annealing the pure metal layer of cobalt to react the pure metal layer of cobalt with the silicon layer to form cobalt silicide while the pure metal layer of cobalt which contacts the dielectric layer remains unreacted; and

removing the pure metal layer of cobalt which remains after annealing the pure metal layer of cobalt.

7. (original) The method of claim 6 further comprising heating the pure metal layer of cobalt, the silicon layer, and the dielectric layer to a temperature of between about 350°C and about 600°C during the annealing.

8. (original) The method of claim 6 further comprising forming a digit line contact which contacts the silicide.

9. (original) The method of claim 6 further comprising forming a capacitor bottom plate which contacts the silicide.

10. (original) A method to form an electronic device comprising:

placing a substrate assembly into a deposition chamber;

introducing cyclopentadienylcobalt dicarbonyl into the chamber to deposit a cobalt metal precursor layer by atomic layer deposition over the surface of the substrate assembly;

introducing hydrogen into the deposition chamber to convert the precursor layer such that a pure metal layer of cobalt having a first thickness remains over the surface of the substrate assembly;

removing the substrate assembly having the cobalt metal layer formed thereover from the deposition chamber;

immersing the substrate assembly having the cobalt metal layer into a plating solution which uses the cobalt metal layer as a seed layer; and

removing the substrate assembly from the plating solution, wherein subsequent to removing the substrate assembly from the plating solution the cobalt metal layer has a second thickness which is thicker than the first thickness.

11. (original) The method of claim 10 wherein the immersing of the substrate further comprises immersing the substrate assembly having the pure metal layer of cobalt into a plating solution comprising about 0.082 molar $CoSO_4 \bullet 7H_2O$, 0.502 molar H_3BO_3, and about 0.169 molar $NaH_2PO_2 \bullet 2H_2O$.

12. (original) The method of claim 11 further comprising heating the plating solution to about 90°C prior to immersing the substrate assembly into the plating solution.

13. (original) The method of claim 12 further comprising formulating the plating solution to a pH of between about 8.8 to about 9.0.